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(54) Massagers

(57) A massager is composed of a linear compressor (2) having a piston (3) which is intermittently attracted by an electromagnet (4) and at other times repelled by a spring (7) to produce compressed air having a safe pressure, i.e. having a relatively low difference between the rated pressure and the maximum pressure, a distributor (30) for allowing compressed air fed from the compressor (2) to be selectively discharged therefrom, and a bag having a plurality of air-tight sections (not shown) which are successively expanded by receiving the compressed air fed from the distributor (30), which includes a rotary member (34) and a stationary member (40) formed with passages therethrough for also allowing exhaust of the compressed air from the air-tight sections.

FIG.2

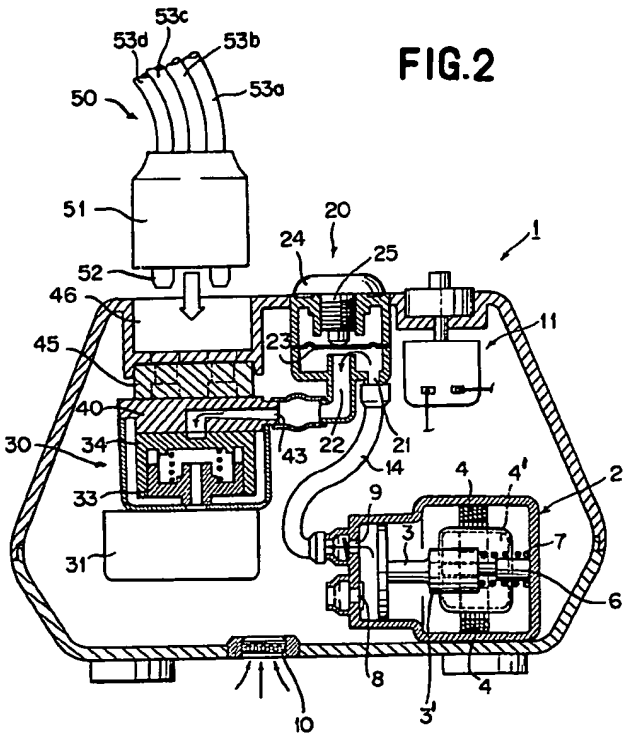

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FIG.1

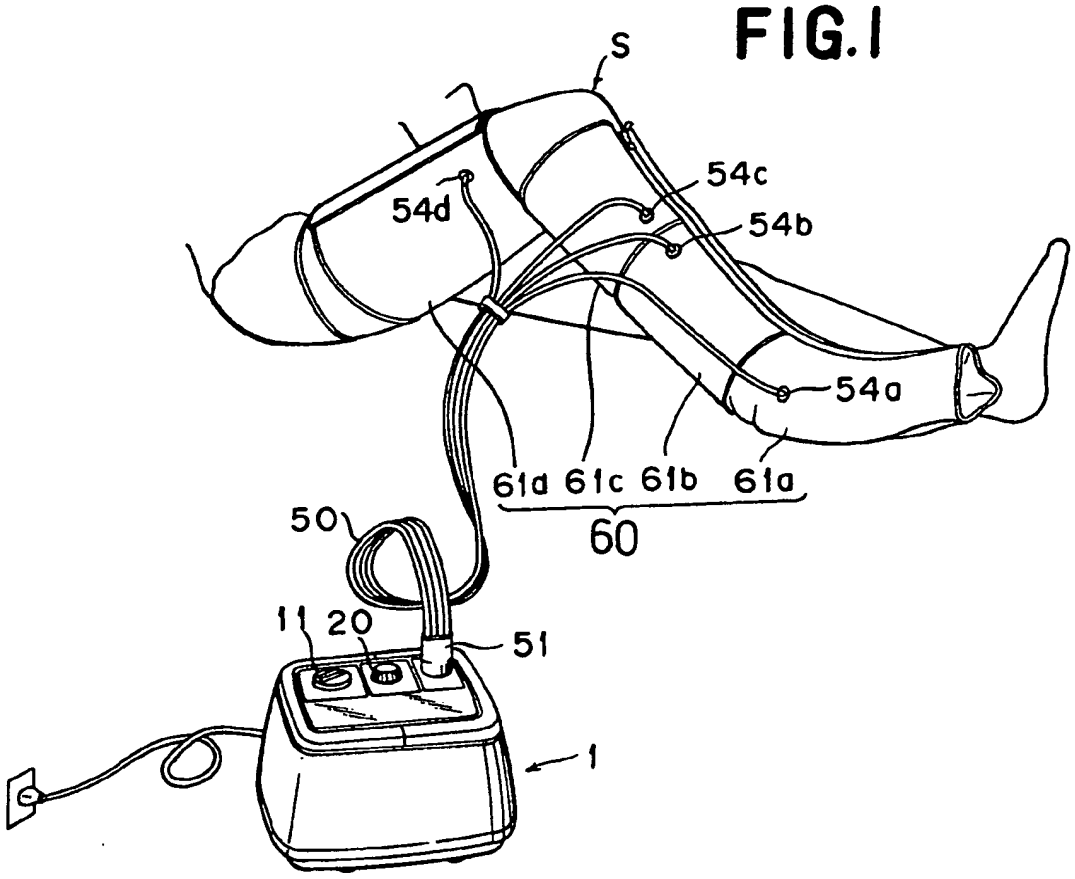
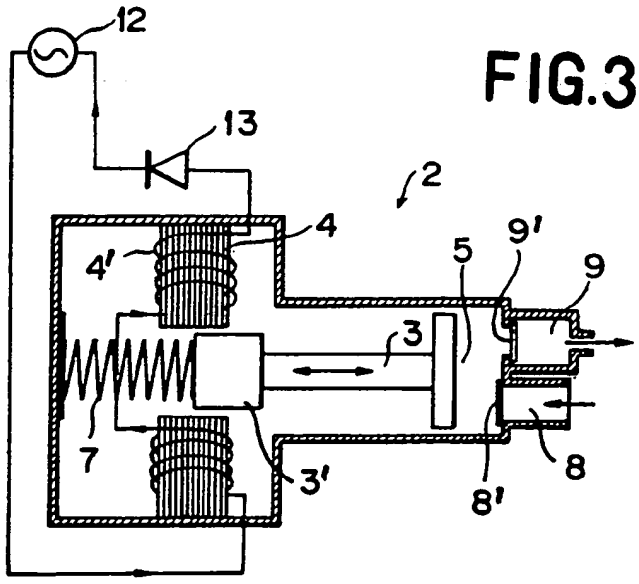

S
54c
54d
54b
54a
61d 61c 61b 61a
60
50
11 20
51
1

FIG.3


12
13
2
4
4'
5
9'
9
3
7
3'
8'
8

2068737

FIG.2

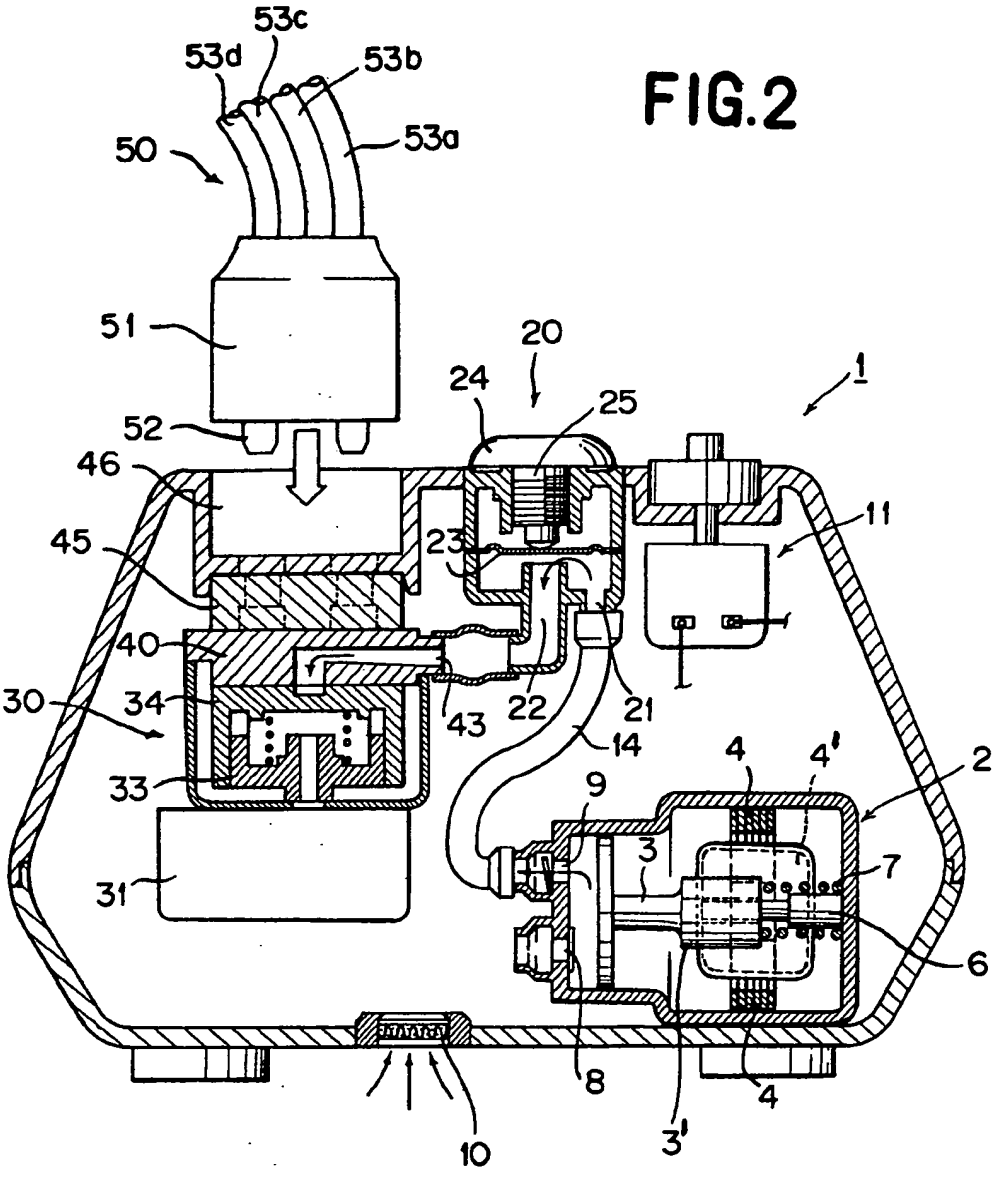


FIG.4

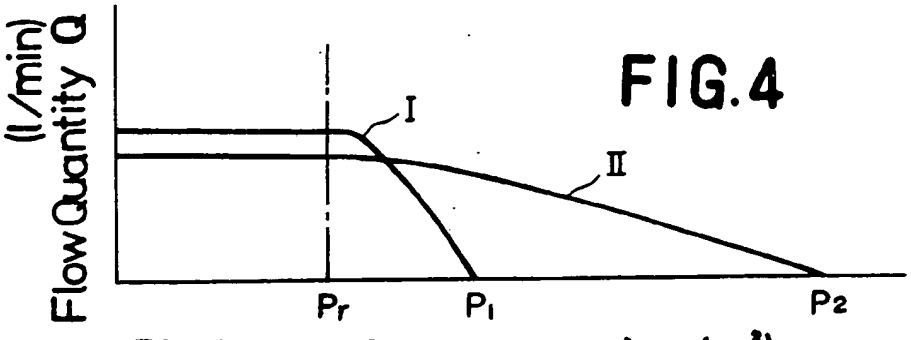


FIG.5

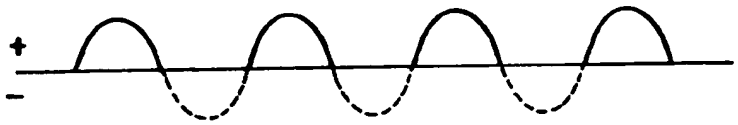


FIG.6A

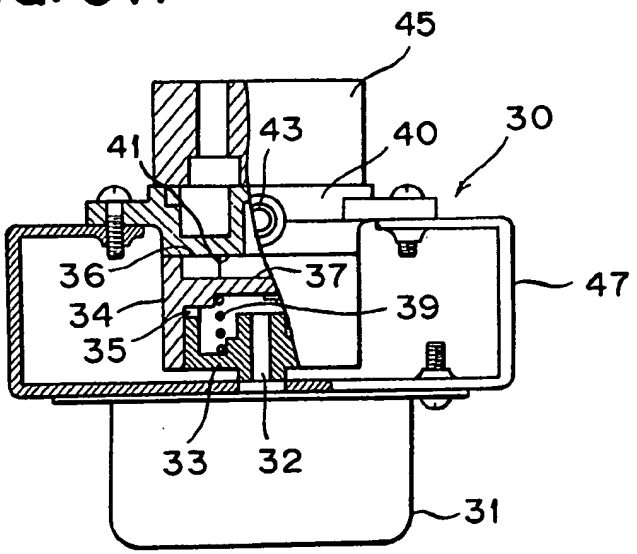


FIG.6B

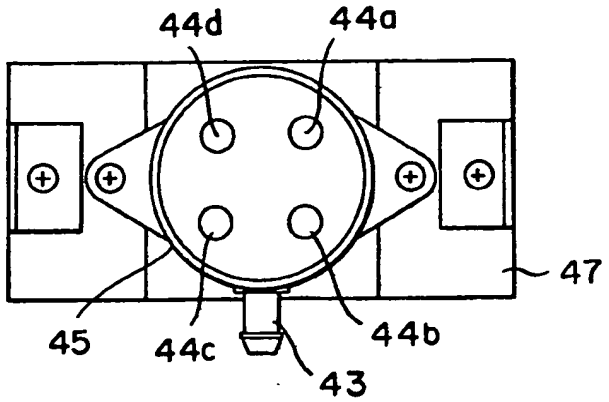


FIG.7A

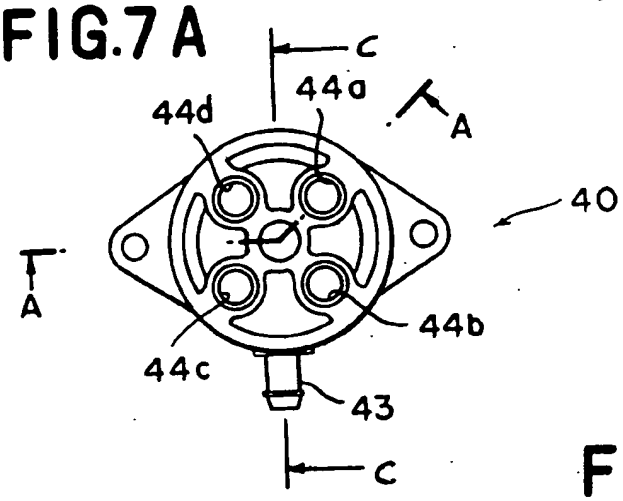


FIG.7B

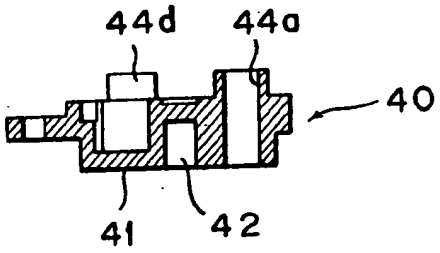


FIG.7C

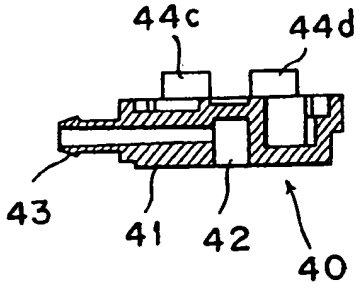


FIG.8A

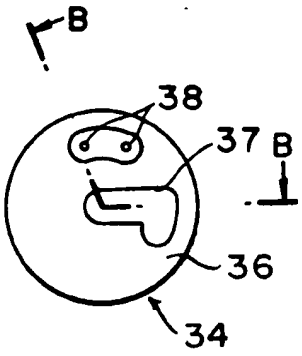


FIG.8B

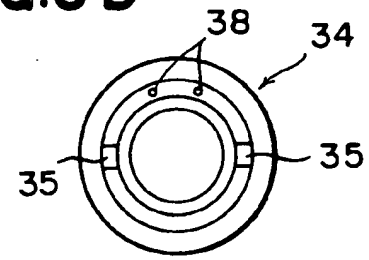
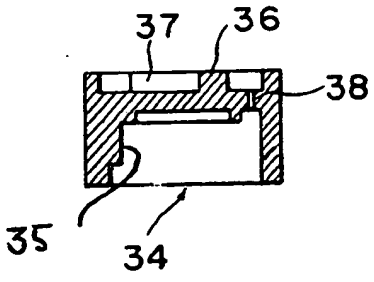


FIG.8C



SPECIFICATION

Massagers

This invention relates to massagers which utilize compressed air of safe pressure and are simple in structure and easy of operation.

It is known to massage the skin or muscles of a subject by means of a massager provided with a bag of rubber or the like, which is wound round a portion to be treated on the subject and is periodically expanded by supplying thereto a pressure fluid, such as compressed air, to exert massaging pressure upon the portion to be treated. In massagers of this type, to improve the massaging effect, the bag is partitioned into several air-tight sections and the pressure fluid is successively fed into the air-tight sections by use of a distributing valve. Examples of such massagers are described in Japanese Patent Publication No. 41794/1976 and Japanese Utility Model Publication No. 17673/1978.

The former art is distinguished by having four electromagnetic switching valves corresponding to four massaging bags, the valves being individually controlled by means of a rotary switch possessed of four contacts so as to supply compressed air successively to each one of the bags. In the latter art, a supply of compressed air to four massaging bags is carried out by use of a set of four pilot valves, for delivering the compressed air to the respective bags, and another set of four transferring valves for controlling the aforesaid pilot valves. Such a complex mechanism depending on a complicated pipe arrangement is clearly a serious drawback.

Besides, the massagers of this type including the foregoing massagers make use of either a rotary compressor or a diaphragm compressor as a means for producing the pressure fluid. The use of a massager incorporating such a compressor on a living body is not at all satisfactory from the viewpoint of safety. This is because the difference between the rated pressure and the maximum pressure of such compressors is relatively large, thereby entailing the possibility of the presssure produced in the massager becoming too high. To cope wich such a disadvantage, massagers of this type have needed to be provided with relief valves and regulator valves to ensure a safe pressure for massaging the subject, but involving the dangers of an accident to the valves.

In accordance with the present invention, however, a massager comprises:—

an electromagnetic linear compressor including electromagnet means, which is operable to cause a piston having an armature to be intermittently attracted and/or intermittently repelled by the force of magnetism generated by said electromagnet means, said piston being reciprocally movable to produce compressed air;

a distributor including a stationary member having an admission passage for receiving compressed air fed from said compressor and a plurality of inlet/outlet ports arranged around said admission passage, a rotary member rotatably mounted with respect to said stationary member and a motor for constantly rotating said rotary member being provided on a surface abutting said stationary member with a connecting recess for sequentially connecting said admission passage to each of said inlet/outlet ports, and with at least one escape hole located behind said connecting recess in relation to the rotational direction of said rotary member for sequentially connecting each of said inlet/outlet ports to exhaust; and

at least one bag including at least one air-tight section to be periodically inflated and deflated when connected with a corresponding one of said inlet/outlet ports.

It has been found that with massagers in accordance with the present invention, incorporating electromagnetic linear compressors, the difference between the rated pressure and the maximum pressure can be kept relatively small and, therefore, massagers in accordance with the present invention can be used safely on a living body even for domestic use, on contrast to supervised medical use.

Preferably, said piston is intermittently moved by a spring in the opposite direction to that of magnetic attraction generated by said electromagnet means, and an alternating current is applied to a diode to subject the current to a half-wave rectification before the current is applied to said electromagnet means.

A massager in accordance with the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:—

Figure 1 is an explanatory diagram illustrating the operation principle of a preferred massager according to the present invention;

Figure 2 is a sectioned side view of the controller;

Figure 3 is a schematic diagram of the compressor;

Figure 4 is a characteristic diagram in respect of the relationship between the flow quantity and the discharge pressure for the present and conventional compressors;

Figure 5 illustrates the waveform of an electric current rectified by use of a diode;

Figures 6A and 6B are, respectively, a partially sectioned side view and a plan view of the distributor;

Figures 7A, 7B and 7C are, respectively, a plan view and sectioned side views, taken along the lines A-A and C-C of Figure 7A, of the stationary member in the distributor; and

Figures 8A, 8B and 8C are, respectively, a plan view, a bottom view and a sectioned side view taken along the line B-B of Figure 8A, of the rotary member in the distributor.

FIG. 1 illustrates a condition in which the massager according to the present invention is used for the purpose of massaging the leg of the subject S. The massager is mainly composed of a controller 1 for producing and discharging compressed air, one or more bag means 60 which are expanded by means of the compressed air produced by the controller 1 to exert massaging pressure upon the leg of the subject S, and an air-delivering means 50 for feeding the compressed air from the controller 1 to the bag means 60. In order to heighten the massaging effect according to the foregoing massager in this embodiment means are used, one being posses-

sed of three air-tight sections 61*a*, 61*b* and 61*c* and the other being possessed of one air-tight section 61*d*, and then the compressed air is successively supplied to the respective air-tight sections. As described so far, the conventional massager requires a plurality of separate valve means for controlling a supply of compressed air to the respective air-tight sections of the bag means. However, in this invention, compressed air constantly retaining a safe pressure can be effectively fed to the respective air-tight sections by a single distributing means being simple in structure.

The controller is, as schematically illustrated in FIG. 2, mainly composed of an electromagnetic linear compressor 2 for producing compressed air, a regulator 20 for regulating the flow rate of the compressed air delivered from the compressor 2 and a rotary distributing means 30 for sequentially forwarding to each air-tight section of the bag means 60 the compressed air fed from the regulator 20. The controller 1 is further provided with a timer 11 for adjusting the time required for massaging. The linear compressor 2 is, as also illustrated in FIG. 3, composed of an electromagnet means 4 having two poles around which induction coil 4' is wound, a piston 3 provided with an armature 3' to be attracted by force of magnetic attraction generated by the electromagnet means 4, a coil spring 7 urging the piston 3 toward a compression chamber 5, an intake port 8 provided with a check valve 8' and a discharge port 9 provided with a check valve 9'. The electromagnet means 4 intermittently generates magnetism by applying to the induction coil 4' thereof an alternating current from the power source 12 to intermittently attract the armature 3' of the piston 3, thereby causing the piston to be moved toward the electromagnet means 4. When the coil 4' of the electromagnet means 4 is relieved of an electric current, the piston 3 is turned back by force of the repelling power of the coil spring 7. As a consequence of a supply of an alternating current to the electromagnet means 4, the piston 3 is reciprocally moved in proportion to the frequency of the alternating current. The reciprocating motion of the piston is securely carried out by the aid of a guide rod 6 fixedly disposed on the body of the compressor. The check valve 8' provided on the intake port 8 functions to permit air introduced into the interior of the controller 1 through a filter 10 to flow into the compression chamber 5, and on the other hand, the check valve 9' provided on the discharge port 9 functions to permit the air introduced into the compression chamber 5 through the intake port 8 to be discharged from the compressor chamber 5. That is, air is fed into the compression chamber 5 by way of the filter 10 and the intake port 8 and is compressed and discharged through the discharge port 9, with the reciprocating motion of the piston 3.

The electromagnetic linear compressor 2 of the aforesaid structure has the following advantage. As shown by the curve I in FIG. 4, the discharge pressure *P* produced by the compressor being used in this invention is stabilized at a relatively low pressure P_1 when the pressure exceeds the rated pressure P_r of the compressor and *Q* is reduced. That is, a difference between the maximum pressure which can be produced by the present linear compressor and the rated pressure thereof is relatively small. However, in the conventional rotary compressor, for example, as shown by the curve II in FIG. 4, the discharge pressure *P* still more rises when the pressure exceeds the rated pressure P_r thereby reducing the flow quantity *Q* and, consequently, the pressure is stabilized at a considerably higher pressure P_2. From the disclosure thus far made, it can be concluded that the present massager using the linear compressor is rather applicable to a living body in comparison with the conventional massager using common rotary compressor.

In this embodiment, a normal alternating current (full-wave current) may be applied to the compressor 2. A half-wave rectified current as illustrated in FIG. 5, which is obtained by passing an alternating current through a rectifier (diode) 13 as illustrated in FIG. 3 may also be applied to the compressor 2. As a result of applying a half-wave rectified current to the compressor, the electromagnet means 4 generated intermittent magnetism so that the piston 3 can turn back toward the compression chamber 5 by the repelling force of the spring 7 when no voltage is generated on the negative side in a current waveform as illustrated in FIG. 5. Consequently, the piston is certainly reciprocated in proportion to the frequency of the alternating current thus applied to produced pressure suitable for massaging the subject.

The compressed air discharged from the compressor 2 is fed to the flow rate regulator 20 through a feeding tube 14. The regulator 20 has a diaphragm 23 which is forced downwardly by driving a screwed spindle 25 being movable axially by use of a knob handle 24. The regulator 20 is further provided with an outlet nozzle 22 on the opposite side of the diaphragm 23 to the screwed spindle 25 so as to leave a small gap between the nozzle 22 and the diaphragm 23. The compressed air produced by the compressor 2 is fed into the regulator 20 from an inlet port 21 and discharged from the outlet nozzle 22 through the small gap between the nozzle 22 and the diaphragm 23. When the screwed spindle 25 is moved downwardly, the gap between the nozzle and the diaphragm further narrows to reduce a discharge amount of the compressed air. By such a way, the massaging pressure to be exerted on the subject can be adjusted.

Referring to FIGS. 2 and 6 through 8, the rotary air-distributing means 30 for selectively discharging the compressed air fed from the regulator 20 to the respective air-tight sections of the bag means 60 will be disclosed hereinafter. The distributing means 30 is mainly composed of a motor 31, a rotary disc 33 fixed on a motor shaft 32 of the motor, a rotary member 34 with ribs 35 which are engaged with the peripheral edge of the rotary disc 33 to transmit to the rotary member 34 rotational motion of the rotary disc 33 being rotated by means of the motor 31, and a stationary member 40 whose lower surface 41 comes into close contact with the upper surface 36 of the rotary member by force of a spring 39 continuy member 34 upwardly.

The stationary member 40 is fixed on a frame 47 mounted on the motor 31 and provided in the center portion of the lower surface 41 thereof with an admission passage 42. The compressed air fed from the compressor 2 through the regulator 20 is introduced into the admission passage 42 via a through hole 43. Around the admission passage 42, there are provided inlet/outlet ports 44*a*, 44*b*, 44*c* and 44*d* of the same number as the air-tight sections 61*a*-61*d* of the bag means at an equal distance to one another.

Meanwhile, the rotary member 34, as illustrated in FIG. 8, has on its upper surface 36 a connecting recess 37 for communicating the admission passage 42 with one of the ports 44*a*-44*d* of the stationary member 40, and one or more throttle holes 38 for escaping the compressed air introduced into the air-tight sections of the bag means, which throttle holes are placed behind the connecting recess in relation to the rotary direction of the rotary member 34.

When the motor 31 is driven in such a state that the rotary member 34 and the stationary member 40 are coupled with each other, the compressed air fed via the through hole 43 and the admission passage 42 is successively discharged from each of the ports 44*a*-44*d*, and consequently, the compressed air is supplied to the corresponding section of the bag means by the medium of the air-delivering means 50. Through the throttle holes 38 communicated with one of the ports 44*a*-44*d*, the compressed air supplied to the corresponding section of the bag means 60 is discharged and then it is released to the outside of the distributing means 30 through the narrow gap between the rotary disc 33 and the rotary member 34. This air-delivering means 50 is composed of four pipes 53*a*, 53*b*, 53*c* and 53*d* for connecting the relative ports 44*a*-44*d* with the corresponding sections 61*a*-61*d*, respectively. A plug 51 capable of being fitted in a socket 46 of the controlled 1 is provided at one end of the air-delivering means 50 so that the plug terminals 52 thereof can be detachably inserted into a block 45 to communicate with the ports 44*a*-44*d*. At the other end of the air-delivering means 50, there are provided a plurality of couplers 54*a*, 54*b*, 54*c* and 54*d* to be detachably connected with coupler-receptables each mounted on the respective sections 61*a*-61*d* of the bag means. FIG. 1 illustrates a condition of use, in which the controller 1 and the bag means 60 wound around the subject *S* are connected with each other by means of the air-delivering means 50. In this state, when the compressor 2 and the distributing means 30 are operated, compressed air is successively supplied to the respective sections of the bag means, thereby giving the massaging pressure to the subject *S*.

As is clear from the foregoing disclosure, the massager according to the present invention enjoys an advantage that massage can safely and reliably be carried out by use of the compressor capable of producing a relatively low pressure difference between the rated pressure and the maximum output pressure and the simply constructed air distributing means. This massager which is composed of simple mechanisms and permits reduction in size is made handy and used as a controlling the spacing between said

Although, in the above-described preferred embodiment, the electromagnet means generates only intermittent magnetic attraction, it will be appreciated that the generation of only intermittent magnetic repulsion would be operative in conjunction with for example a spring continuously biasing the piston towards the electromagnet means, and indeed the circuitry could be such that the electromagnet means cyclically generates attraction followed by repulsion so that a spring is no longer desirable.

CLAIMS

1. A massager comprising:

an electromagnetic linear compressor including electromagnet means, which is operable to cause a piston having an armature to be intermittently attracted and/or intermittently repelled by the force of magnetism generated by said electromagnet means, said piston being reciprocally movable to produce compressed air;

a distributor including a stationary member having an admission passage for receiving compressed air fed from said compressor and a plurality of inlet/outlet ports arranged around said admission passage, a rotary member rotatably mounted with respect to said stationary member and a motor for constantly rotating said rotary member, said rotary member being provided on a surface abutting said stationary member with a connecting recess for sequentially connecting said admission passage to each of said inlet/outlet ports, and with at least one escape hole located behind said connecting recess in relation to the rotational direction of said rotary member for sequentially connecting each of said inlet/outlet ports to exhaust; and

at least one bag including at least one air-tight section to be periodically inflated and deflated when connected with a corresponding one of said inlet/outlet ports.

2. A massager according to claim 1, wherein said piston is disposed within a compression chamber having intake and discharge ports each having a check valve, said piston being intermittently moved by a spring in the opposite direction to that of magnetic attraction generated by said electromagnet means.

3. A massager according to claim 1 or claim 2, further comprising a diode through which an alternating current is applied to subject the current to a half-wave rectification before the current is applied to said electromagnetic means.

4. A massager according to any preceding claim, wherein said compressor and said distributor are both located within a housing of a controller.

5. A massager according to claim 4, further comprising a filter installed on the housing of said controller and adapted to pass air therethrough into the housing of said controller.

6. A massager according to any preceding claim, further comprising a flow rate regulator disposed between said compressor and said distributor and possessed of an outlet nozzle and a diaphragm spaced from said outlet nozzle, whereby the amount of compressed air discharged from said regulator is

outlet nozzle and said diaphragm.

7. A massager according to any preceding claim, further comprising delivering means including a plurality of pipes each capable of being detachably connected for communication at its one end with a respective one of said inlet/outlet ports and at its other end with a respective one of said air-tight sections.

8. A massager according to any preceding claim, further comprising a timer for controlling a period during which compressed air is produced by said compressor.

9. A massager according to any preceding claim, wherein said rotary member is continuously urged to maintain its abutment with said stationary member.

10. A massager according to claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

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